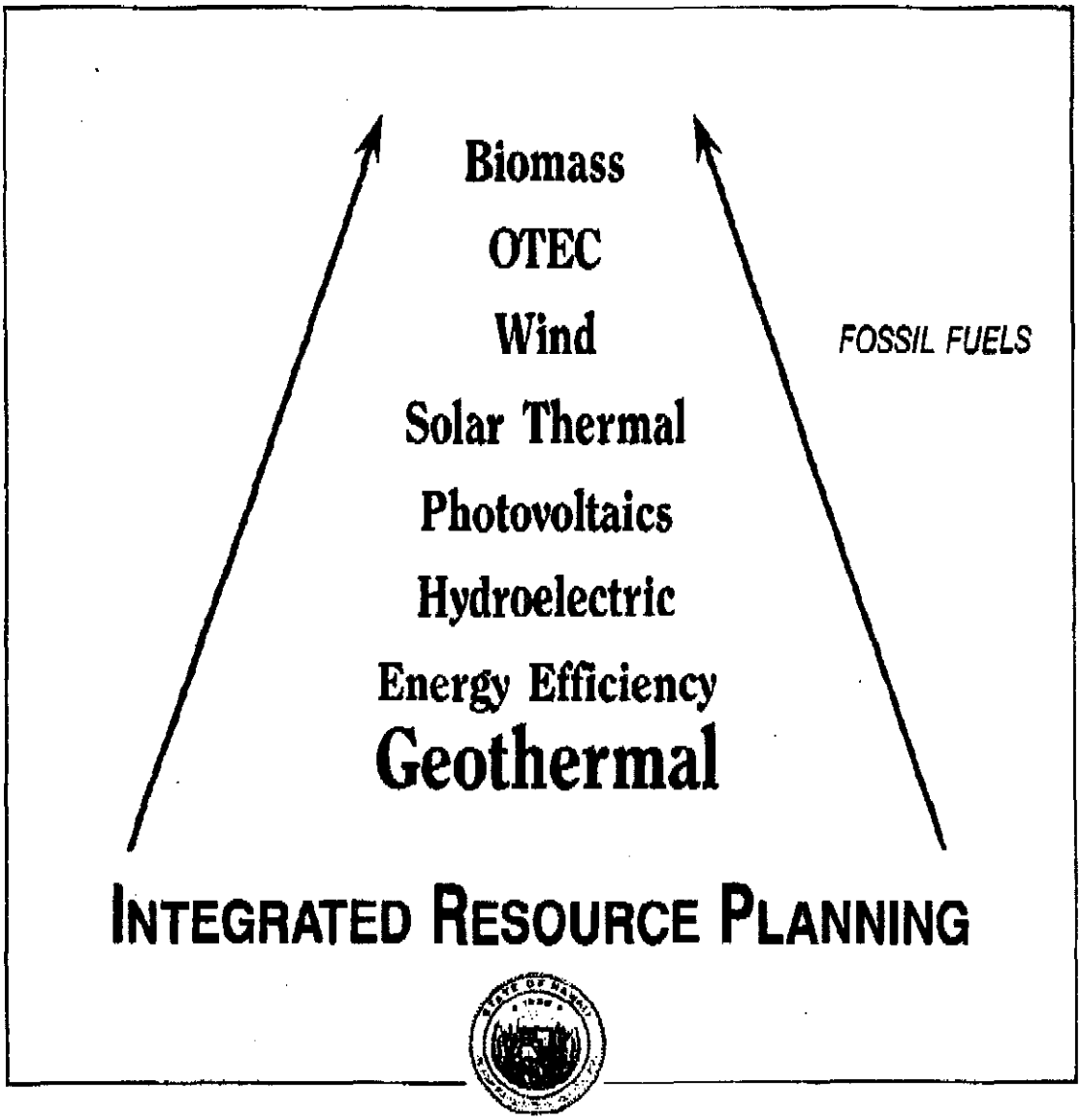
GEOTHERMAL

PART OF THE MIX IN HAWAII'S ENERGY FUTURE



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ELECTRICAL POWER FROM NATURAL STEAM

What is Geothermal?

"Geo," meaning "earth," and "thermal," referring to "heat," geothermal energy is heat stored deep below the earth's surface. In Hawaii, surface indications of our geothermal resource include volcanic eruptions and features such as steam vents and hot springs. To bring the earth's energy to the surface, where it can be used, wells are drilled into the ground so heat can be obtained in the form of steam or hot fluids.

Like the heat created by burning fuel oil or coal, geothermal heat can be converted into electricity to serve the everyday needs of home and office. Used directly, the heat can also be used in a variety of agricultural and industrial processes, such as drying fruit or sterilizing a variety of materials.

FACTS

Geothermal vs. Fossil Fuels

1. The "Blueprint for the Environment — Advice to the President-elect from America's Environmental Community" found that fossil fuels are responsible for about half the greenhouse gases that are warming the earth and that energy decisions must move towards the use of clean, renewable energy sources, including geothermal.

2. The use of geothermal energy could provide an important contribution to reducing U.S. carbon dioxide emissions which contribute to the greenhouse effect and global warming. For example, *substituting 500 megawatts of geothermally-produced electrical energy for an equivalent amount of energy produced by burning oil would reduce carbon dioxide emissions to the same extent as that produced by 450,000 acres of trees, i.e., a forest that occupies an area of 20 miles by 35 miles.*

3. Ormat's planned 25 megawatt plant would displace 20 million gallons of oil per year. This means that 20 million gallons of oil do not have to be transported each year from one environmentally sensitive area to another. In this plant all the geothermal fluids are injected back deep into the ground and air is used for cooling.

Hawaii is Still Too Oil Dependent

Hawaii depends upon oil for 90 percent of its energy needs.

Almost 10 percent of the gross state product goes to buy this oil.

—However, Hawaii is Trying to Become Self-Reliant

- Hawaii is much more energy efficient — since the early 1970's there has been a 16 percent reduction in per capita energy use.

- For over a decade, Hawaii's strategy has been to reduce our reliance on imported oil for electrical generation through the development of clean energy alternatives. We have made significant progress. Of the 393,000 households in Hawaii, 11 percent (45,000 homes) use solar water heaters.

- In addition, approximately 55,000 households use heat pump water heaters, each with an annual savings of five barrels of oil. With more than 25 percent of our household units relying on solar and heat pump water heaters, Hawaii's per capita energy conservation savings is more than any other state.

- Advances have also been made in other renewable energy fields. Today, over 33 megawatts of wind power have been installed statewide, and the Island of Hawaii has a far higher percentage of its electric capacity contracted to wind power generators than any other utility in the nation. A 20-kilowatt utility-scale solar electric plant is operating on Maui, the largest photovoltaic installation in the state. Research also continues in ocean thermal energy conversion and biomass crops.

- The state is moving rapidly to develop demand-side management programs that will curb the need for additional power plants. Demand-side management are utility programs designed to control energy consumption on the customer's side of the meter. Such programs include conservation/energy efficiency, load management, fuel substitution, and other programs.

Protecting and Preserving Our Lands

Although Hawaii is the 4th smallest State in the country, it ranks 7th highest in State-owned forest lands. The State of Hawaii encompasses 4 million acres of land. Of these:

- Over 900,000 acres are State forest reserve
- 270,000 acres are national park and wildlife refuges

GEOTHERMAL
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- 46,000 acres are private conserves under management of the Nature Conservancy. These are cherished lands.

At the end of 1989, the State announced the expansion of forest reserves on the Big Island by 15,000 acres in the Kona area.

In the last two years, the State Department of Land and Natural Resources produced and distributed 900,000 tree seedlings, planted 850 acres of land, and prepared hundreds more for new planting. The Department of Land and Natural Resources' budget for natural conservation is $15.4 million and includes a state-of-the-art Endangered Species Captive Rearing Project. In addition, last year Hawaii beefed up its land-banking law with a $20 million appropriation for the public acquisition of privately owned unique lands. Also in 1989, Hawaii became the first state to pass a law limiting the sale of CFC-containing refrigerants to protect the ozone layer.

Hawaii's rain forests are not "imperiled" by our careful approach to geothermal energy development. A 100-megawatt geothermal facility would require clearing about 300 acres of Class C (less pristine) lowland tropical rain forest. That's one-half percent of the 60,000 acres of forests in the vicinity. The State exercises safeguards to protect the integrity and survival of the native rain forest. More discussion on the rain forest can be found on page 4 of this brochure.

COMMONLY ASKED QUESTIONS AND ANSWERS

1.
Why must Hawaii develop alternative energy?

Development of alternative energy is essential for the displacement of oil as Hawaii's primary energy source. Utilization of Hawaii's abundant resources of indigenous, non-fossil energy — geothermal, ocean thermal, solar thermal, photovoltaic, biomass, wind, hydropower and others — must be developed to achieve the State's energy goals.

Actions facilitating the development and commercialization of alternative energy resources include: (1) providing financial and regulatory incentives for development; (2) making the development process less costly and time consuming; (3) finding means of storing intermittent energy so that it can be used to provide continuous power; (4) assessing and mitigating possible environmental impacts; and (5) providing a reliable, economic method of transporting energy from one island of the State to others.

2.
How is the State planning for energy use and conservation for the near term and into the next century?

The State is utilizing a process called *Integrated Resource Planning* (IRP). In early January 1990, the Public Utilities Commission issued an order to utilities to implement IRP. IRP is an approach to utility planning that requires the assessment of all known resources for both the production of energy, i.e., the supply-side, and the consumption of energy, i.e., the demand-side, against an array of broadly-defined cost-benefit considerations. In the IRP process, provisions are included for public participation and input by public agencies, including regulatory commissions before decisions are made on resource acquisitions or investments.

Specifically for geothermal, the State is formulating a *master plan* to guide the development of the most promising geothermal resources on the Big Island. This plan will cover all aspects of the development, and its effects on the community, the environment, the economy, and will be based on public involvement.

3.
What has the State done to develop alternative energy?

Since the energy crisis in the mid-1970's, Hawaii has made progress in many alternative energy technologies. Hawaii is the site of the world's largest wind turbine. A utility-scale solar electric plant has joined hundreds of small residential photovoltaic installations in making use of our tropical sun. Our state has the highest per capita use of solar water heaters and heat pumps in the nation. Experimental plantings of many varieties of trees and other crops continue to identify the most suitable lands and species for biomass energy. Research into ocean thermal energy conversion technologies continues in Kona, at the world's premier OTEC laboratory. However, of all the renewable energy technologies, only geothermal is ready, today, to provide firm, reliable electricity. It is a technology which has a proven track record throughout the world.

GEOTHERMAL—
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4.
How does geothermal compare with other energy alternatives in terms of cost and commercial availability?

Geothermal is the only indigenous resource, available in large quantities, which can be converted to baseload (24 hours per day) electricity and is commercially mature. It is the means by which Hawaii can best reduce its 90 percent dependence on imported oil for its overall energy needs and 90 percent for its electricity. The other alternate energy resources such as solar and wind technologies cannot yet provide firm, baseload power in sufficient quantities. In 1988, biomass accounted for about 30 percent of the Big Island's electricity. However, biomass energy in Hawaii is tied to the sugar industry, which is in a precarious position.

5.
Wouldn't energy conservation eliminate the need to develop geothermal energy?

The IRP planning process, described on page 3 of this brochure, represents a commitment by the State to pursue demand-side management (DSM) through the Public Utilities Commission. The State policy is to save as much as possible. This policy encompasses all utility programs and activities aimed at modifying the timing and level of customer demand.

Conserving energy and increasing the efficiency by which we use energy are vital first steps in any integrated energy plan. Through a large number of factors, including conservation and energy efficiency, a 16 percent reduction per capita has been obtained. However, even after our residents and businesses are made as efficient as possible, we will still need electricity to keep up with increasing growth.

If this electricity is generated by oil-fired power plants, our state will still be dependent on imports of an environmentally-damaging substance, available only in limited amounts, and controlled primarily by foreign governments. It is absolutely essential to increase our energy efficiency, but if our electricity generation remains dependent on imported oil, we will not have achieved energy self-reliance. A mix of energy options, as envisioned by Hawaiian Electric Company, will contribute to the State's power demands. The State will continue to guide the progress of renewable energy development for Hawaii.

6.
Will geothermal development violate Native Hawaiian rights to religious freedom, as well as other traditional and cultural practices?

No. The Hawaii Supreme Court has rejected efforts to bar geothermal development on religious grounds; the U.S. Supreme Court upheld the Hawaii Supreme Court's decision by refusing to hear the appeal.

7.
Will geothermal destroy the rain forest?

According to the Department of Land and Natural Resources' Forestry and Wildlife Division, a lowland tropical rain forest is defined as: (1) Less than 3,000 feet in elevation; (2) receiving at least 100 inches of rain annually; and (3) containing more than 50 percent native tree canopy cover.

The Wao Kele O Puna rain forest is not the last lowland rain forest in the United States. There are eight other lowland rain forests that exist on Maui, Kauai, Oahu, Molokai, and Hawaii.

Hawaii's native rain forests are not "imperiled" by our careful approach to geothermal energy development. Most of the lands designated as geothermal subzones are not forested at all; much of the acreage is in highly impacted non-prime agricultural land. Even the forested acreage is not pristine native forest, but has already been invaded and damaged by significant numbers of alien plants, animals, and residential development.

One cannot legitimately compare geothermal development in a rain forest to destruction of a rain forest such as in Brazil. In general, those rain forests are being destroyed by clearing through logging and slash and burn. Such massive vegetation removal is being conducted without regard to the environment, sensitive soil conditions or habitat.

Damage to native forest can be minimized by proper management techniques, which are part of the permit requirements each developer must follow. Careful location of roads and well sites to avoid sensitive areas, clearing no more acreage than is absolutely necessary, eliminating weed growth along the roadways, and controlling the movement of people and animals (such as pigs) through the forest are ways that the quality of the forest can be maintained. Stringent enforcement of these measures is essential to avoid degrading the forest habitat.